(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平8－55357

(43)公開日　平成８年(1996)２月27日

(51)Int.Cl.[6]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ１１Ｂ	7/125	Ａ	7247－5D		
	7/135	Ｚ	7247－5D		
	7/14		7247－5D		

審査請求　未請求　請求項の数４　ＯＬ　（全８頁）

(21)出願番号　特願平6－193259

(22)出願日　平成６年(1994)８月17日

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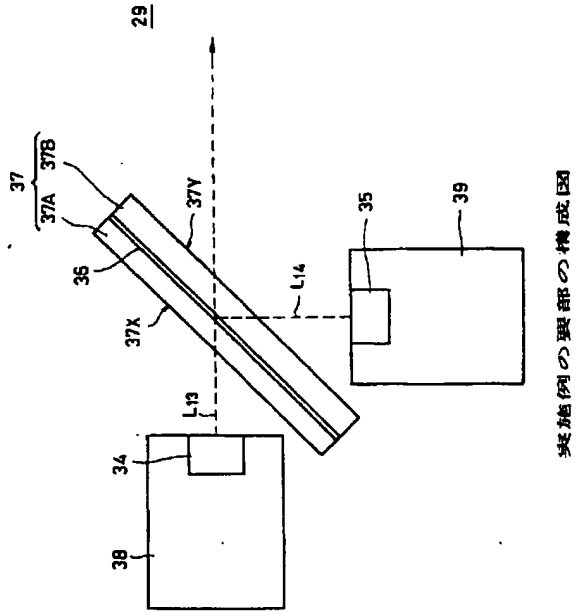
(54)【発明の名称】　半導体レーザ装置

(57)【要約】

【目的】　発振波長の異なる半導体レーザを備えた半導体レーザ装置の非点隔差補正を可能にし且つ小型、薄型、軽量化を図る。

【構成】　パッケージ内に発振波長の異なる複数の半導体レーザチップ３４，３５と、各半導体レーザチップからの出射光の光軸を同一光軸上に一致させるための、出射光を透過・反射する光学誘電体多層膜のダイクロイックミラー３６を形成した透光性の平行平面板３７とを設け、各出射光の水平成分に関する光軸が平行平面板に対して斜めに透過するように配置した構成とする。



実施例の要部の構成図

PAT-NO: JP408055357A
DOCUMENT-IDENTIFIER: JP 08055357 A
TITLE: SEMICONDUCTOR LASER DEVICE

Abstract Text - FPAR (1):

PURPOSE: To the **correct astigmatic** difference of a semiconductor laser device provided with semiconductor lasers having **different oscillation wavelengths,** to miniaturize the device, to make the device thinner and to lighten the weight of the device.

Abstract Text - FPAR (2):

CONSTITUTION: Plural semiconductor laser chips 34, 35 having different oscillation wavelengths and a translucent parallel **flat plate** 37 for aligning optical axes of exit lights from respective semiconductor lasers tip on the same optical axis and in which the dichroique mirror 36 of an optical dielectric multilayer film transmitting and reflecting exit lights is formed are provided in a package. These are arranged so that optical axes for horizontal components of respective exit lights are made to pass obliquely with respect to the parallel **flat plate**.

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention has two or more semiconductor laser chips with which semiconductor laser equipment differs from oscillation wavelength, and astigmatic difference amendment is made by each and it relates to small [of equipment], a thin shape, and the semiconductor laser equipment in which lightweight-izing is possible.
[0002]
[Description of the Prior Art] In semiconductor laser, the semiconductor laser of a gain guide mold has the property in which the oscillation by the return flux of light is hard to be disturbed, compared with the semiconductor laser of vertical single mode dispatch like the semiconductor laser of an index guide mold for vertical multimode oscillation. For this reason, the semiconductor laser of a gain guide mold does not have the increment in the noise level resulting from the self-bonding effectiveness by the return flux of light from a reading side etc., and is used as the light source of optical pickup of the optical disk player as which especially a high S/N ratio is required.
[0003] However, the point of the light (light of a horizontal component) emitted in a field parallel to a laser plane of composition (the so-called field of a barrier layer) emitting light differs from the point of the light (light of a vertical component) emitted in a field perpendicular to a laser plane of composition emitting light, and this gain guide type of semiconductor laser has the optical property with the so-called astigmatic difference.

[0004] Namely, the light beam 2 by which outgoing radiation is carried out from the semiconductor laser 1 of a gain guide mold as shown in drawing 13 A and B is emission light, and is radiation angle thetaa of a proper in a field (X-Z page) perpendicular to the inside of a field (X-Y side) parallel to a laser plane of composition (field of a barrier layer 3). thetab It has.
[0005] And radiation angle thetab Light Lb of the spreading vertical component It is radiation angle thetaa to the point A emitting [virtual] light being the end face (namely, mirror plane) 4 of semiconductor laser 1. The point B of the light La of the spreading horizontal component emitting [virtual] light turns into the point of having gone into the back from an end face 4. Therefore, light Lb of the vertical component within a field perpendicular to a laser plane of composition in this light beam 2 Light La of the horizontal component within an parallel field The points emitting [virtual] light differ and astigmatic difference deltaZ as used in the field of on optics arises.
[0006] When the semiconductor laser of the above-mentioned gain guide mold is used as the light source of optical pickup of optical disk players, such as a compact disk (CD) and a mini disc (MD), astigmatic difference deltaZ has a bad influence on reproducing characteristics.
[0007] In order to amend such the astigmatic difference conventionally, the semiconductor laser equipment of a configuration as shown in drawing 11 and drawing 12 is proposed. The semiconductor laser chip 15 of a gain guide mold is attached through the submounting member 14 on the pedestal 13 in a package 12, and this semiconductor laser equipment 11 is the optical axis LO of a laser beam in the aperture of a package 12. It receives and is predetermined include-angle thetaA in the laser plane of composition (X-Y side) of the semiconductor laser chip 15. It arranges, the plane-parallel plate 16, for example, the parallel flat-surface glass

plate, of translucency, and changes so that it may incline.
[0008] According to the configuration of this semiconductor laser equipment 11, as shown in drawing 11 in a field parallel to a laser plane of union Horizontal component light La Optical axis LO By penetrating aslant to the parallel flat-surface glass plate 16 Seemingly, the point B emitting [virtual] light is the vertical component light Lb, as it moves to the end-face (mirror plane) side of the laser chip 15 and is shown in drawing 12 in a field perpendicular to a laser plane of composition on the other hand. Optical axis LO Since it penetrates at a right angle, the point A emitting [virtual] light does not change to the parallel flat-surface glass plate 16. Therefore, the astigmatic difference is amended by making the leaned parallel flat-surface glass plate 16 penetrate.
[0009] When the system which, on the other hand, makes refreshable the optical disk of specification with which light source wavelength differs, i.e., an optical disk, is standardized according to recording density, the system chooses the light source of specific wavelength according to the specification of the optical disk, respectively, and it enabled it to reproduce with common equipment has been developed. It is desirable from the simplification of a configuration, and the point of a manufacturing cost to share-ize optical system as much as possible to the light source from which oscillation wavelength differs as optical pickup used in such a system.
[0010] From such a demand, the light source section 20 as shown in drawing 10 is considered. In drawing 9 , the semiconductor laser equipment with a wavelength of 780nm with which 21 becomes the 1st light source and with which semiconductor laser equipment with a wavelength of 680nm and 22 become the 2nd light source, for example, and 23 show a dichroic mirror. The outgoing radiation light (optical axis L11) from the 1st semiconductor laser equipment 21 penetrates a dichroic mirror 23, and it consists of this light source section 20 so that the outgoing radiation light (optical axis L12) of the 2nd semiconductor laser equipment 22 may reflect with a dichroic mirror and may be in agreement with the same optical axis as the optical axis L11 of the outgoing radiation light from the 1st semiconductor laser equipment 21. Each outgoing radiation light after **** will pass along common optical system. The 1st and 2nd semiconductor laser equipment 21 and 22 takes the same configuration as the semiconductor laser equipment 11 of above-mentioned drawing 10 here.
[0011]
[Problem(s) to be Solved by the Invention] By the way, in the light source section 20 of drawing 1010 mentioned above, since the 1st and the 2nd semiconductor laser equipment 21 and 22, and the discrete part of dichroic mirror 23 grade construct and it consists of **, the thing become a design top problem -- there are many components mark and the dimension of optical system and the volume become large -- is expected. In the example of drawing 10 , the dimension of the vertical ax horizontal bx depth c of the light source section 20 becomes more than 10mmx10mmx5.6mm, and the further miniaturization of optical pickup, thin-shape-izing, and lightweight-ization become difficult. Moreover, it is not avoided that an optical adjustment man day increases, either.
[0012] This invention has two or more semiconductor laser chips with which oscillation wavelength differs in view of an above-mentioned point, and is made as for astigmatic difference amendment to each, miniaturization of the whole equipment, thin-shape-izing, and lightweight-ization are enabled, and optical adjustment processes can be reduced, and the semiconductor laser equipment closed if [apply and] for optical pickup is offered.
[0013]
[Means for Solving the Problem] Two or more semiconductor laser chips 34 and 35 with which the semiconductor laser equipment concerning the 1st this invention differs in oscillation wavelength in a package 30, In order to make the opticals axis L13 and L14 of the outgoing radiation light from each semiconductor laser chips 34 and 35 in agreement on the same optical axis, The parallel face-plate 37 of translucency with which the optical dielectric multilayers 36 which pass and reflect outgoing radiation light were formed is formed, and it arranges and constitutes so that the opticals axis L13 and L14 about the horizontal component of each outgoing radiation light may penetrate aslant to a plane-parallel plate 37.
[0014] In the semiconductor laser equipment of the 1st invention, only in one of the fields, the 2nd this invention forms the optical dielectric multilayers 41, and constitutes a plane-parallel plate 37.
[0015] The 3rd this invention unifies and constitutes a plane-parallel plate 37 on both sides of the optical dielectric multilayers 36 in the semiconductor laser equipment of the 1st invention among the plates 37A and 37B of two sheets.

[0016] The 4th this invention performs and constitutes acid-resisting processing to the wavelength of said outgoing radiation light which carries out incidence of the plane-parallel plate 37 to the fields 37X and 37Y in which the optical dielectric multilayers 36 are not formed, or 37Z in the 1st, the 2nd, or the semiconductor laser equipment of the 3rd invention.

[0017]

[Function] In the 1st this invention, the outgoing radiation light from the semiconductor laser chip 34 with the oscillation wavelength of 1 penetrates the plane-parallel plate 37 with which the optical dielectric multilayers 36 were formed, and the outgoing radiation light from the semiconductor laser chip 35 with other oscillation wavelength is in agreement with the optical axis L13 of the outgoing radiation light from the semiconductor laser chip in which it reflects in by the optical dielectric multilayers 36, and the optical axis L14 has the oscillation wavelength of 1. Therefore, both outgoing radiation light will pass the optical system to share after it.

[0018] And since a plane-parallel plate 37 is aslant arranged to the opticals axis L13 and L14 of the horizontal component of each outgoing radiation light, the optical axis about the vertical component of the outgoing radiation light from each laser chips 34 and 35 is penetrated to a plane-parallel plate 37 at a right angle, it comes to penetrate aslant the opticals axis L13 and L14 about the horizontal component of each outgoing radiation light to a plane-parallel plate 37, and the astigmatic difference of each outgoing radiation light is amended.

[0019] Moreover, since the plane-parallel plate 37 in which two or more semiconductor laser chips 34 and 35 and optical dielectric multilayers 36 were formed in the package 30 is arranged, the miniaturization of a package 30 and thin shape-ization are attained. Moreover, since it is unified within a package 30 and constituted as one component, when it applies, for example to the light source section of optical pickup, the components mark which constitute optical pickup decrease and reduction of the adjustment man day at the time of the optical-system assembly of optical pickup can be aimed at.

[0020] In the 2nd this invention, as shown in drawing 8 , by forming the optical dielectric multilayers 41 only in one field of the plane-parallel plates 37 The effective board thickness of the plane-parallel plate 37 which the outgoing radiation light from the semiconductor laser chip 35 of 1 penetrates It becomes the same as the board thickness of a plane-parallel plate 37, since it reflects by the optical dielectric multilayers 41, the effective board thickness of the plane-parallel plate which the outgoing radiation light from other semiconductor laser chips 34 penetrates becomes twice the board thickness of a plane-parallel plate 37, and a difference arises in the effective board thickness which each outgoing radiation light penetrates. The astigmatic difference from which the laser chip with which each oscillation wavelength differs differs by this is amended independently.

[0021] In the 3rd this invention, as shown in drawing 3 , by unifying on both sides of the optical dielectric multilayers 36 among the plates 37A and 37B of two sheets, and constituting a plane-parallel plate 37 If it is ** and the board thickness of the plates 37A and 37B of two sheets is placed by carrying out, the effective board thickness of the plane-parallel plate 37 which the outgoing radiation light from the semiconductor laser chip 34 of 1 penetrates will serve as the sum total of the board thickness of the plates 37A and 37B of two sheets. Since it reflects by the optical dielectric multilayers 36, the effective board thickness of the plane-parallel plate 37 which the outgoing radiation light from the semiconductor laser chip 35 of another side penetrates becomes twice the board thickness of one plate 37B, and a difference produces it in the effective board thickness which each outgoing radiation light penetrates. The astigmatic difference from which the laser chip with which each oscillation wavelength differs differs by this is amended independently.

[0022] In the 3rd this invention, the refractive index of the glass ingredient of a plate (37A, 37B) may be changed, and effective board thickness may be adjusted. Moreover, the board thickness and the refractive index of a plate (37A, 37B) may be changed, and effective board thickness may be adjusted combining these board thickness and a refractive index.

[0023] In the 4th this invention, the loss of a laser beam which carries out incidence decreases by performing acid-resisting processing to this in the fields 37X, 37Y, and 37Z in which the optical dielectric multilayers 36 (or 41) of a plane-parallel plate 37 are not formed to the wavelength of the outgoing radiation light (namely, laser beam) which carries out incidence.

[0024]

[Example] Hereafter, the example of the semiconductor laser equipment applied to this invention with reference

to a drawing is explained.

[0025] Drawing 1 and drawing 2 are one example of this invention. Drawing 3 is the block diagram showing the important section. This example forms the thin (rectangular parallelepiped) package 30 in which the window part 32 which arranges the parallel flat-surface glass plate 31 of translucency, and carries out outgoing radiation of the laser beam was formed in one side face. In this package 30, the 1st semiconductor laser chip 34 (for example, laser chip with an oscillation wavelength of 500nm shown with the oscillation spectrum of drawing 4), The 2nd semiconductor laser chip 35 (for example, laser chip with an oscillation wavelength of 780nm shown with the oscillation spectrum of drawing 5), The dichroic mirror (light with a wavelength of 500nm penetrates), i.e., the permeability property shown in drawing 6 R> 6, which consists of optical dielectric multilayers light with a wavelength of 780nm -- reflecting -- it arranges, the plane-parallel plate 37, for example, the parallel flat-surface glass plate, of the translucency in which the dichroic mirror 36 which it has was formed, and semiconductor laser equipment 29 is constituted.

[0026] The semiconductor laser chips 34 and 35 are attached on the submounting member 38 which consists of silicon etc., for example, respectively, and 39, and these submounting members 38 and 39 are arranged on the inner base of a package 30. At this time, each semiconductor laser chips 34 and 35 are attached so that outgoing radiation of the opticals axis L13 and L14 of that laser beam may be carried out in the direction parallel to the inner base of a package 30, the top face of the submounting members 34 and 35, etc., and so that outgoing radiation of both the opticals axis L13 and L14 may be carried out from the same height.

[0027] Between [of two sheets] translucency parallel flat-surface glass plate 37A and 37B, on both sides of a dichroic mirror 36, three persons unify and the parallel flat-surface glass plate 37 is constituted. This parallel flat-surface glass plate 37 is aslant arranged so that that plate surface may become a predetermined include angle to the opticals axis L13 and L14 of the outgoing radiation light from each laser chip 34 and 35, especially its horizontal component, respectively, while being arranged between the 1st and 2nd semiconductor laser chips 34 and 35. In this example, it is arranged so that 45 degrees may incline to each optical axis L13 and L14.

[0028] As mentioned above, as for amendment of the astigmatic difference, it is effective to lean and arrange the parallel flat-surface glass plate 37 to the optical axis of a laser beam. It makes as [make / make a right angle carry out incidence of the optical axis about the vertical component (component light in a field perpendicular to a laser plane of composition) of the laser beam by which outgoing radiation was carried out from the laser chips 34 and 35 to the parallel flat-surface glass plate 37, and / the incidence of the optical axis about the horizontal component (component light in a field parallel to a laser plane of composition) of a laser beam / carry out aslant to the parallel flat-surface glass plate 37] in that case.

[0029] With the configuration of drawing 3 , with the parallel flat-surface glass plate 37, the outgoing radiation light from the 1st semiconductor laser chip 34 penetrates a dichroic mirror 36, and goes straight on. The outgoing radiation light from the 2nd semiconductor laser chip 35 is reflected with a dichroic mirror 36. At this time, the reflected light shaft reflected with the dichroic mirror 36 of outgoing radiation light from the 2nd semiconductor laser chip 35 is adjusted so that it may be in agreement with the transmitted light shaft which carried out outgoing radiation from the 1st semiconductor laser chip 34, and penetrated the dichroic mirror 36.

[0030] When the above 1st and the 2nd semiconductor laser chip 34 and 35 are a gain guide mold semiconductor laser chip, it has the astigmatic difference of a proper, respectively. When using these 1st and 2nd semiconductor laser chips 34 and 35 as the light source for optical disks, amendment of the astigmatic difference is needed (it is desirable to make the astigmatic difference into zero).

[0031] Generally, when the oscillation wavelength of the 1st and 2nd semiconductor laser chips 34 and 35 differs, the amounts which should amend the astigmatic difference differ.

[0032] On the other hand, the amount As of astigmatic difference amendments by the plane-parallel plate is given with several 1 theoretical formula.

[0033]

[Equation 1]

$$As = \frac{t}{\sqrt{N^2 - \sin^2\theta}} \left[\frac{N^2 \cos^2\theta}{N^2 - \sin^2\theta} - 1 \right]$$

For the refractive index t of a plane-parallel plate, the board thickness theta of a plane-parallel plate is [N] the

inclination (namely, angle with the optical axis which carries out slanting transparency with the normal of a plane-parallel plate to make) of a plane-parallel plate.
[0034] It is set to N= 1.49, t= 0.25mm, theta= 30 degrees, then amount As=of astigmatic difference amendments27.6micrometer in several 1 formula. For example, it is set to N= 1.49, t= 0.25mm, theta= 45 degrees, then amount As=of astigmatic difference amendments67.6micrometer.
[0035] Now, with the 1st semiconductor laser chip 34, 40.0 micrometers presupposes that 27.0 micrometers is required of the 2nd semiconductor laser chip 35 respectively as an amount of astigmatic difference amendments.
[0036] In the configuration of drawing 3 , if referred to as thickness t1 =100micrometer of inclination [of theta= 45 degrees] parallel flat-surface glass plate 37A of the refractive index N= 1.49 of the parallel flat-surface glass plate 37, and the parallel flat-surface glass plate 37, and thickness t2 =50micrometer of parallel flat-surface glass plate 37B Since effective thickness t of the parallel flat-surface glass plate 37 which the outgoing radiation light of the 1st semiconductor laser chip 34 penetrates penetrates the glass plates 37A and 37B of two sheets Effective thickness t of the parallel flat-surface glass plate 37 which is set to t1+t2 =100micrometer+50micrometer=150micrometer, and the 2nd semiconductor laser chip 35 penetrates Since it reflects with a dichroic mirror 36, it is the board thickness t2 of the same glass plate 37B. A twice as many distance as this will be passed and it is set to t2+t2 =50micrometer+50micrometer=100micrometer.
[0037] Therefore, As=27.0micrometer is obtained [chip / 34 / 1st / semiconductor laser] about As=40.6micrometer and the 2nd semiconductor laser chip 35, and, as for the amount As of astigmatic difference amendments, both astigmatic difference amendments are attained.
[0038] Thus, in the semiconductor laser equipment 29 of this example, the astigmatic difference of each semiconductor laser chips 34 and 35 can be amended independently, respectively, and the miniaturization of a package 30 and thin shape-ization are attained, and lightweight-ization of semiconductor laser equipment 29 also becomes possible. Incidentally, by this example, the magnitude of a package becomes less than [vertical a1 x horizontal b1 x height c1 =5mmx5mmx2mm], and the semiconductor laser equipment which the volume reduced or less to 1/10 as compared with drawing 9 is obtained.
[0039] In the parallel flat-surface glass plate 37 of drawing 3 , the refractive index of the glass ingredient of the parallel flat-surface glass plates 37A and 37B can be changed, respectively, and effective board thickness can also be adjusted. Moreover, the board thickness and the refractive index of the parallel flat-surface glass plates 37A and 37B can be changed, and effective board thickness can also be adjusted combining these board thickness and a refractive index.
[0040] In addition, in an upper example, although the parallel flat-surface glass plate 37 was constituted on both sides of the dichroic mirror 36 between [of two sheets] parallel flat-surface glass plate 37A and 37B As shown in drawing 8 R> 8, in addition, only to one field of the parallel flat-surface glass plates 37 of one-sheet structure For example, it can also consider as the configuration in which the dichroic mirror 41 which consists of optical dielectric multilayers which have the permeability property (reflecting light with a wavelength of 500nm light with a wavelength of 780nm penetrates) shown in drawing 7 was formed. In this case, a dichroic mirror 41 is made to penetrate the outgoing radiation light (optical axis L14) from the 2nd semiconductor laser chip 35, and it makes as [reflect / with a dichroic mirror 41 / the outgoing radiation light (optical axis L13) from the 1st semiconductor laser chip 34].
[0041] Moreover, the fields 37X and 37Y in which dichroic mirrors 36 and 41 are not formed in drawing 3 and the parallel flat-surface glass plate 37 of drawing 8 , or 37Z can also be coated with acid-resisting processing, for example, the antireflection film, so that the laser beam of the wavelength by which incidence is carried out may not be reflected here. Thus, by performing acid-resisting processing, loss of the laser beam which penetrates the parallel flat-surface glass plate 37 can be reduced.
[0042] Drawing 9 is the case where the semiconductor laser equipment 29 of this example is applied to the light source of the optical pickup 50 of an optical disk player. In this drawing, in 51, a disk and 53 show a lens system and, as for a beam splitter and 52, 54 shows a photo detector. It is reflected by the beam splitter 51 and the laser beam 55 which carried out outgoing radiation from the 1st [of semiconductor laser equipment 29] or 2nd laser chip 34 or 35 is irradiated by the field of a disk 52 through a lens system 53. The laser beam reflected in respect of the disk is detected by the photo detector 54 through a lens system 53 and a beam splitter 51, and

reading of information is performed.
[0043] Thus, the semiconductor laser equipment 29 concerning this example reduces the components mark of optical pickup, and enables further miniaturization and thin shape-ization. Moreover, since semiconductor laser equipment 29 is constituted as one component, the adjustment man day at the time of the assembly of the optical system of optical pickup is reducible.
[0044]
[Effect of the Invention] while being able to amend independently the astigmatic difference of two or more semiconductor laser chips with which oscillation wavelength differs, respectively according to the semiconductor laser equipment concerning this invention -- the whole -- a miniaturization and thin-shape-izing -- it can lightweight-ize. Moreover, a part of whole serves as elegance by arranging in a package the plane-parallel plate which has two or more semiconductor laser chips and optical dielectric multilayers. Therefore, reduction of the components mark which optical pickup constitutes is achieved, and miniaturization of optical pickup, thin-shape-izing, and lightweight-ization are attained, and the semiconductor laser equipment of this invention can reduce the adjustment man day at the time of optical-system assembly further, when it applies to the light source of optical pickup for example.
[0045] respectively independent to the semiconductor laser of the oscillation wavelength from which all differ, when using the plane-parallel plate which forms optical dielectric multilayers only in one field of a plane-parallel plate, and grows into it as a plane-parallel plate which constitutes semiconductor laser equipment, or when using the plane-parallel plate which unifies, and forms and changes on both sides of optical dielectric multilayers between the plane-parallel plates of two sheets -- astigmatic difference amendment can be carried out.
[0046] Furthermore, when performing acid-resisting processing to the field in which the optical dielectric multilayers of a plane-parallel plate are not formed to the wavelength of the outgoing radiation light by which incidence is carried out to this, i.e., a laser beam, the loss of a laser beam which carries out incidence can be reduced.

[Translation done.]

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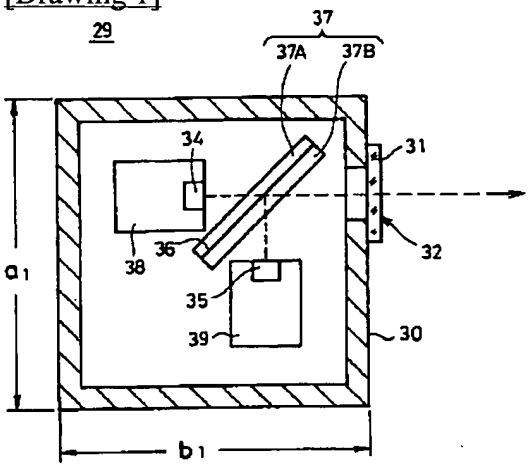
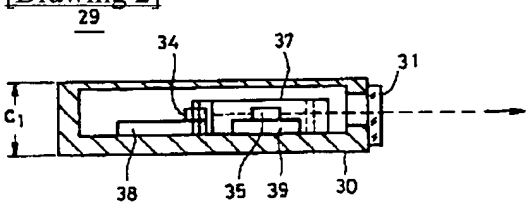
DRAWINGS

[Drawing 1]



本実施例の上方より見た断面図

[Drawing 2]



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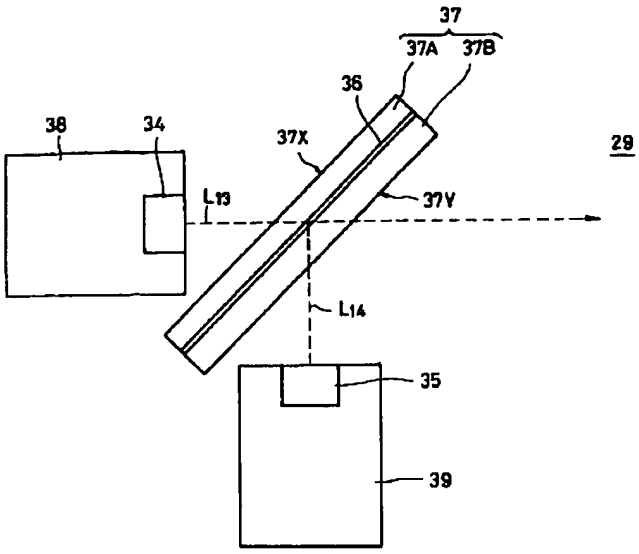
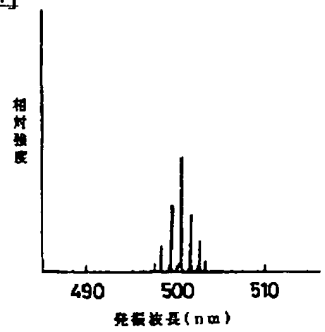
[Drawing 3]



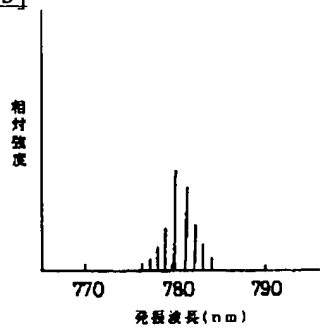
実施例の要部の構成図

[Drawing 4]



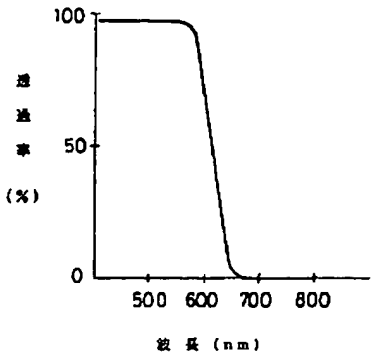
第1の半導体レーザチップの発振スペクトル

[Drawing 5]



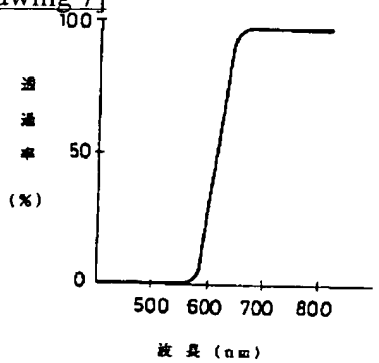
第2の半導体レーザチップの発振スペクトル

[Drawing 6]



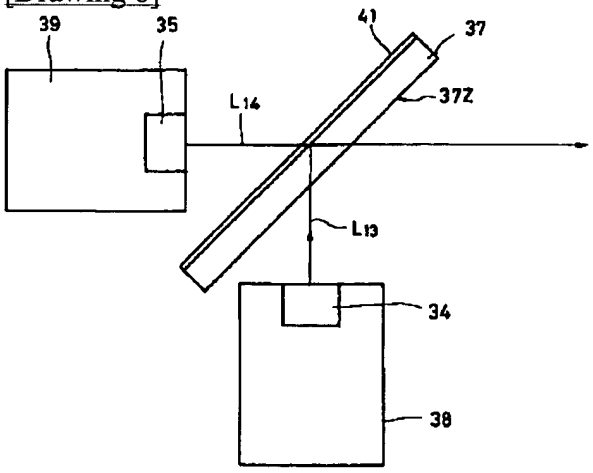
ダイクロイックミラーの透過率特性

[Drawing 7]



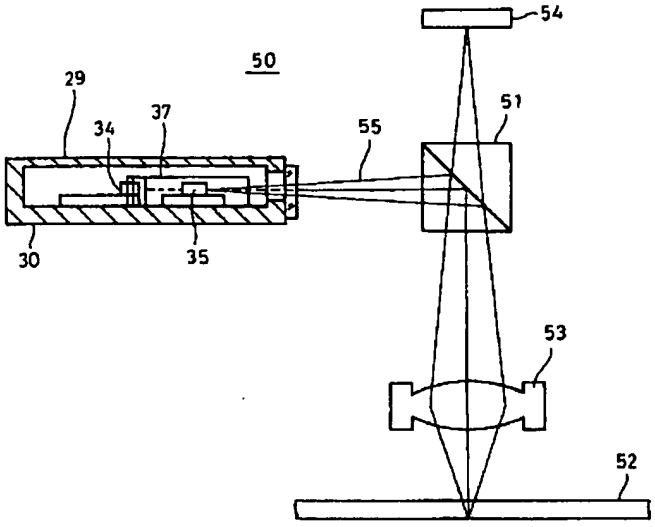
ダイクロイックミラーの透過率特性

[Drawing 8]



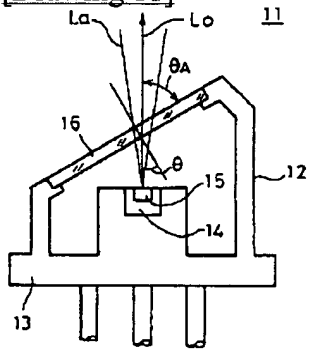
他の実施例の要部の構成図

[Drawing 9]



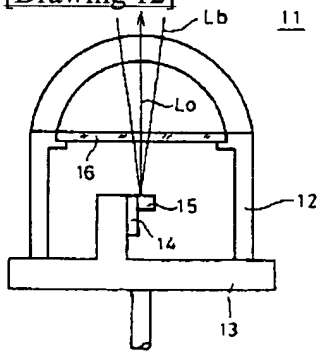
本発明を用いた光学ピックアップの構成図

[Drawing 11]



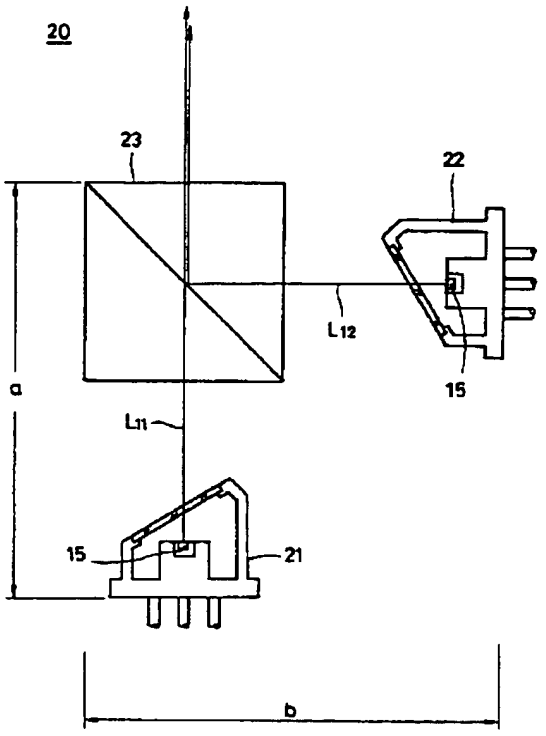
従来例の一方の断面図

[Drawing 12]



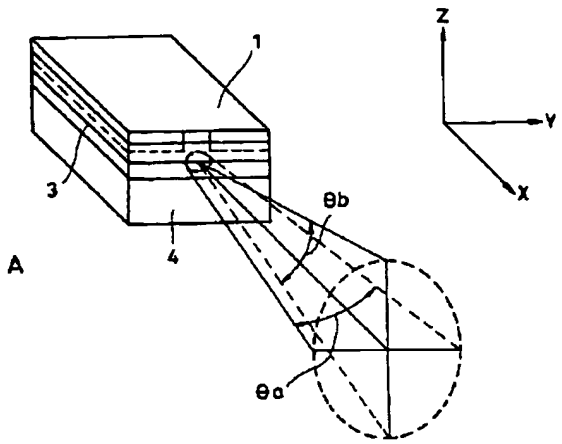
従来例の他方の断面図

[Drawing 10]

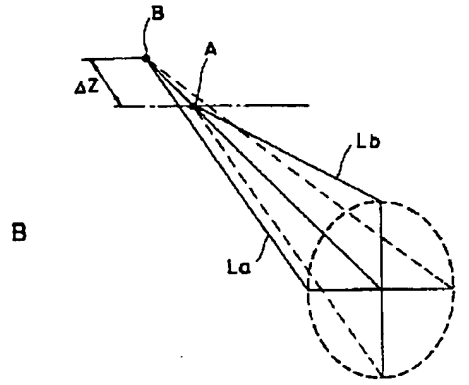


比較例の構成図

[Drawing 13]



半導体レーザの斜視図



レーザの非点隔差の説明図

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view seen from the upper part of the semiconductor laser equipment concerning this invention.
[Drawing 2] It is the sectional view seen from the side of the semiconductor laser equipment concerning this invention.
[Drawing 3] It is the block diagram of the important section of the semiconductor laser equipment concerning this invention.
[Drawing 4] It is the oscillation-spectrum Fig. of the 1st semiconductor laser chip.
[Drawing 5] It is the oscillation-spectrum Fig. of the 2nd semiconductor laser chip.
[Drawing 6] It is the permeability property Fig. of a dichroic mirror.
[Drawing 7] It is the permeability property Fig. of a dichroic mirror.
[Drawing 8] It is the block diagram of an important section showing other examples of the semiconductor laser equipment concerning this invention.
[Drawing 9] It is the block diagram of the optical pickup which used the semiconductor laser equipment of this invention for the light source.
[Drawing 10] Block diagram ****** of the example of a comparison of the light source section.
[Drawing 11] It is a sectional view along a field parallel to the laser plane of composition of conventional semiconductor laser equipment.
[Drawing 12] It is a sectional view along a field perpendicular to the laser plane of composition of conventional semiconductor laser equipment.
[Drawing 13] A It is the perspective view of semiconductor laser. B It is the explanatory view of the astigmatic difference of a laser beam.
[Description of Notations]
1 Semiconductor Laser
2 Laser Beam
3 Barrier Layer
4 End Face (Mirror Plane)
A, B Point emitting [virtual] light
11, 21, 22 Semiconductor laser equipment
15 Semiconductor Laser Chip
16 Parallel Flat-Surface Glass Plate
29 Semiconductor Laser Equipment
30 Package
32 Window Part
34 35 Semiconductor laser chip
36 41 Dichroic mirror of optical dielectric multilayers
37, 37A, 37B Parallel flat-surface glass plate
